WHAT IS CLAIMED IS:

1. A method for authenticating an identification marking, said method comprising the steps of:

ascertaining one or more properties of the marking to provide a measured profile;

comparing said measured profile to at least one member of a closed set of reference profiles, each said reference profile having predetermined values of said one or more properties, each said reference profile being unique within said set, at least one said reference profile being characteristic of an indicator material in a nanocrystalline morphology and non-characteristic of the same indicator material in a bulk morphology.

2. The method of claim 1 wherein another of said reference profiles of said set is characteristic of said indicator material in a bulk morphology and uncharacteristic of said indicator material in a nanocrystalline morphology.

3. The method of claim 1 wherein said indicator material in said nanocrystalline morphology has an absorption peak in the ultraviolet-visible light range and said ascertaining further comprises measuring an absorption spectrum of said marking in the ultraviolet-visible light band.

4. The method of claim 1 wherein said indicator material in said nanocrystalline morphology has an absorption peak in the ultraviolet-visible light range at a wavelength that is shifted relative to a corresponding absorption peak of the same material in a bulk morphology and said ascertaining further comprises measuring absorption of said marking at said wavelength.

5. The method of claim 4 wherein said indicator material in said nanocrystalline morphology has a luminescence emission peak that is shifted relative to a corresponding emission peak of the same material in a bulk

morphology and said ascertaining further comprises measuring emission of said marking at said wavelength during excitation at said wavelength of said absorption peak.

6. The method of claim 5 wherein said ascertaining further comprises determining that said measuring is of a region of said marking substantially free of non-nanocrystalline particles.

7. The method of claim 6 wherein said determining further comprises examining said region by light microscopy.

8. The method of claim 7 wherein said marking includes an inorganic, organic-inorganic, or organo-metallic compound that has at least one atomic species having an atomic number equal to or greater than 11, and said measuring further comprises preparing an X-ray fluorescence spectra of said marking.

9. The method of claim 8 wherein said determining is by one of wavelength dispersive X-ray fluorescence analysis and energy dispersive X-ray fluorescence analysis.

10. The method of claim 8 wherein said inorganic, organic-inorganic, or organo-metallic compound is different than said indicator material.

11. The method of claim 8 wherein said measuring further comprises the steps of:

preparing sections of said marking by dry cryo-ultramicrotomy; and

examining said sections by transmission electron microscopy.

12. The method of claim 11 wherein said examining includes locating a nanocrystalline particulate.

13. The method of claim 12 wherein said examining includes determining an embedment depth of said particulate.

14. The method of claim 1 wherein said indicator material in said nanocrystalline morphology has a luminescence emission peak that is shifted relative to a corresponding emission peak of the same material in a bulk morphology and said measuring further comprises measuring emission of said marking at said wavelength.

15. The method of claim 14 wherein said ascertaining further comprises determining that said measuring is of a region of said marking substantially free of non-nanocrystalline particles.

16. The method of claim 14 wherein said determining further comprises examining said region by light microscopy.

17. The method of claim 16 wherein said marking includes an inorganic, organic-inorganic, or organo-metallic compound that has at least one atomic species having an atomic number equal to or greater than 11, and said measuring further comprises preparing an X-ray fluorescence spectra of said marking.

18. The method of claim 17 wherein said determining is a wavelength dispersive X-ray fluorescence analysis.

19. The method of claim 17 wherein said determining is an energy dispersive X-ray fluorescence analysis.

20. The method of claim 17 wherein said inorganic, organic-inorganic, or organo-metallic compound is different than said indicator material.

21. The method of claim 1 wherein said marking includes an inorganic, organic-inorganic, or organo-metallic compound that has at least one atomic species having an atomic number equal to or greater than 11, and said measuring further comprises determining the X-ray fluorescence spectra of said marking.

22. The method of claim 21 wherein said inorganic, organic-inorganic, or organo-metallic compound is different than said indicator material.

23. The method of claim 22 wherein said determining further comprises examining said region by light microscopy.

24. The method of claim 1 further comprising, prior to said comparing, identifying one member of said closed set of reference profiles that is allocated to said identification marking.

25. The method of claim 24 wherein said identifying further comprises reading an identifier.

26. The method of claim 25 wherein said identifier is encoded and said identifying further comprises decoding said identifier following said reading.

27. The method of claim 24 wherein said identifying further comprises chemically characterizing said compound.

28. The method of claim 27 wherein said characterizing includes analyzing said compound by mass spectroscopy.

29. The method of claim 28 wherein said characterizing includes determining the molecular weight of said compound.

30. The method of claim 27 wherein said characterizing includes conducting secondary ion mass spectrometry of said marking.

31. The method of claim 1 wherein said marking has a modulation of said one or more properties extending along one or more dimensions of said marking and said identifying further comprises reading said modulation.

32. The method of claim 31 wherein said modulation is machine-readable.

33. The method of claim 1 wherein said indicator material is a compound having a molecular weight in the range of 10 to 100,000 Daltons.

34. The method of claim 1 wherein said indicator material is a compound having a molecular weight in the range of 10 to 20,000 Daltons.

35. The method of claim 1 wherein said indicator material is a compound having a molecular weight in the range of 10 to 10,000 Daltons.

36. The method of claim 1 wherein said indicator material is a particulate having particles with diameters of less than 50 nanometers.

37. The method of claim 36 wherein said diameters are less than 30 nanometers.

38. The method of claim 36 wherein said diameters are less than 20 nanometers.

39. The method of claim 1 wherein each said reference profile is characteristic of a mixture of a plurality of indicator materials, each said indicator material being in a nanocrystalline morphology, and each said reference profile is

non-characteristic of a corresponding mixture of the same indicator materials, each being in a bulk morphology.

40. The method of claim 1 further comprising, prior to said ascertaining, printing a swatch having said identification marking.

41. The method of claim 1 further comprising, prior to said ascertaining, printing a swatch having said identification marking on an adhesive label.

42. An authentication apparatus for use with authentication swatches having identification markings, said apparatus comprising:

a testing station receiving said swatches;

an examination head disposed adjoining said station, said examination head being capable of ascertaining one or more properties of the marking to provide a measured profile;

a look-up table having a closed set of reference profiles, each said reference profile having predetermined values of said one or more properties, each said reference profile being unique within said set, at least one said reference profile being characteristic of an indicator material in a nanocrystalline morphology and non-characteristic of the same indicator material in a bulk morphology;

a comparison engine operatively connected to said examination head and said look-up table, said comparison engine being capable of comparing said measured profile with each of said reference profiles.

43. The apparatus of claim 42 wherein said examination head includes an ultraviolet-visible light spectrophotometer.

44. The apparatus of claim 42 wherein said examination head includes a spectroscopy system for micro-luminescence and micro-RAMAN spectroscopy.

45. The apparatus of claim 44 wherein said examination head includes an X-ray fluorescence spectrometer.

46. The apparatus of claim 45 wherein said examination head includes an optical microscope.

47. An authentication system comprising:

a plurality of swatches, each said swatch having an identification marking, said marking including an indicator material in a nanocrystalline morphology; and

an authentication apparatus including:

a testing station configured to receive said swatches;

an examination head disposed adjoining said station, said examination head being capable of ascertaining one or more properties of said identification markings to provide a measured profile;

a look-up table having a closed set of reference profiles, each said reference profile having predetermined values of said one or more properties, each said reference profile being unique within said set, each said reference profile being characteristic of a respective said indicator material in a nanocrystalline morphology and non-characteristic of the same indicator material in a bulk morphology;

a comparison engine operatively connected to said examination head and said look-up table, said comparison engine being capable of comparing said measured profile with each of said reference profiles.

48. The system of claim 47 further comprising a compressed fluid printer capable of generating said indicator material and printing said swatches.

49. The system of claim 47 further comprising a compressed fluid deposition device capable of generating said indicator material and a printer capable of printing said swatches.